7. *Unusual Polarographic Procedures*

Maxima, Maxima Suppressors, Hydrodynamic Theory. Polarographic kinetic, catalytic and adsorption effects. Trends in Organic Polarographic processes. Tensammetry, Double Layer Structure and Electrocapillarity in relation to conventional polarographic theory and practice. The study of Colloidal surfactants.

8. *Amperometry and Amperometric Titrations*

Theoretical Considerations. Single and Dual Polarisable Electrodes. Typical apparatus, cells and titration curves. Rotating platinum microelectrode. Amperometric Dead Stop End point titrations. Karl Fischer Estimation of water.

9. *Electrolysis and Electrogravimetry*

Simple Electrodeposition Processes. Controlled Potential and Constant Current Electrolysis; Electrogravimetric analysis; Successive determination and separation of various metals; Spontaneous Electrogravimetric Analysis; Potentiostats: their function, designs and operation.

10. *Coulometry and Coulometric Analysis*

Coulometric Titrations with constant current: Principles and Techniques. Constant Current Sources. Direct and Indirect Processes. Applications of coulometric titrations with constant current. Automatic Titrators.

11. *Conductometric Analysis*

Conductance, a.c. bridges, cell geometry. Equivalent and Limiting Conductance. Determination of Ionization Constants, Solubility Products and Concentration of Salt Solutions. High frequency conductometric titrations and other analytical applications.

12. *Electrokinetic Phenomena*

Introductory Theory. Electro-osmosis, Streaming Potentials, Electrophoresis, Electrodialysis. Measurements of zeta-potentials. Analytical Applications.

13. *Recent Advances in Polarography*

a.c. polarography; square wave, pulse, oscillographic and chromatopolarography. Advanced Instrumentation.

14. *Miscellaneous Electrochemical Methods*

Anodic Stripping Techniques; Electrographic Analysis; Fast Electrode Processes; Capacitance Measurements.

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UNIVERSITY OF TORONTO
DIVISION OF EXTENSION

ELECTROANALYTICAL CHEMISTRY

SESSION 1963–64

offered in co-operation with
The Chemical Institute of Canada
Toronto Section

THURSDAYS **20 Lectures**

This course has been designed essentially for chemists, engineers and technologists engaged in the field of industrial research, development and quality control, but it will also be of interest to others working in areas related to Electrochemistry. It is intended in part as a refresher course but its principal aim is to serve as an introduction to modern theoretical and practical aspects of the subject. The topics will be discussed from an elementary level leading to more advanced concepts, and the course will be conducted by two staff members of the Department of Chemistry, University of Toronto.

Major topics which will be covered are:

Fundamental Electrochemistry; Simple Electronics; Techniques and Instrumentation of Electrometric Methods; pH theory and measurements; d.c. and a.c. polarography; Amperometry and Amperometric Titrations; Electrolysis and Electrogravimetry; Coulometry and Coulometric Analysis; Potentiometric Titrations; Chronopotentiometry; Conductometric Analysis; Electrokinetic Phenomena; Voltammetric Processes.

LECTURERS: J. A. Page, Ph.D.
Department of Chemistry
University of Toronto
R. G. Barradas, Ph.D.
Department of Chemistry
University of Toronto

TIME: Thursday evenings, 7:30 p.m.
October 10–December 12
January 9–March 12

PLACE: Lash Miller Chemistry Building

FEE: $40.00

Registration:

By mail or in person at Room 201, 84 Queen's Park, 9 a.m. to 5 p.m. daily, except Saturdays. Information may be obtained by telephoning 928–2393, 928–2394, 928–2395 or 928–2396.

PROGRAMME

1. *General Electrochemistry*

Electrochemical Cells, Thermodynamic Concepts, Activity and Concentration, Electrode Potentials, e.m.f., Sign Conventions, Reversible and Irreversible Electrode Processes, Faraday's Laws of Electrolysis, Overpotential, Polarization and Electrochemical Reactions.

2. *Instrumental Analysis*

Basic general review of electrometric methods. Manual and Recording Apparatus used in Electroanalytical Chemistry. E.M.F. and Resistance Measurements. Electrical Units and Standards. Simple Electronics: Power Supplies, Amplifiers, Potentiostatic and Calvanostatic Equipment.

3. *pH Theory and Measurements*

Definitions: pH, pK_a, pK_b, pK_w. Standard Buffer Solutions; pH in non-aqueous solvents, Reference electrodes. Dissociation Constants and Instability Constants, Ligands and Complex Ions.

4. *Potentiometry and Potentiometric Analysis*

Potentiometric Titrimetry Equipment. Standard and Reference Electrodes. Titration Curves of Acids and Bases. Potentiometric Precipitation Titrations; Potentiometric Redox Reactions; Redox Potentials; Nernst Equation and Redox Equilibria; Dead Stop End Points.

5. *Chronopotentiometry*

Voltammetric Measurements at galvanostatic conditions. Simple Theory, Instrumentation and Methodology. Transition Times, Potential-Time Relationships; Kinetic Effects; Interpretation of Chronopotentiograms; Analytical Applications; Determination of Film Thickness.

6. *Polarography*

Principles of Polarography, Diffusion, Mass Transfer, Apparatus, and Cells. Dropping Mercury Electrode, Static Mercury Electrode, Rotating Dropping Mercury Electrode, Rotating Solid Electrode. Distinction between a.c. and d.c. polarography. Interpretation of polarograms; diffusion and limiting currents, half-wave potentials. Polarographic Errors.